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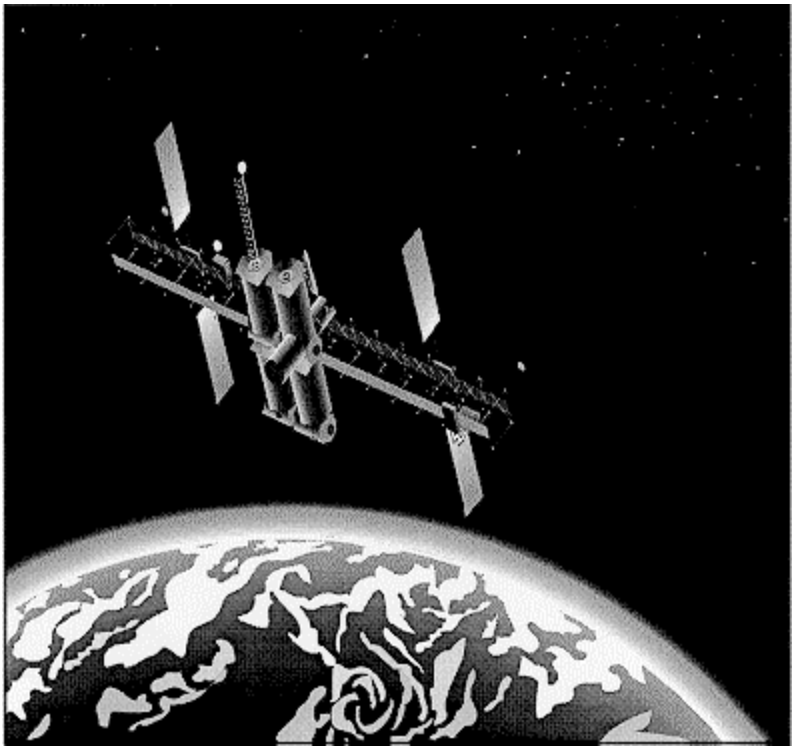
FORT BLISS ARAT-SC HELPS U.S. ARMY PREPARE FOR THE 21ST CENTURY!

(See Page 1)

What's Inside:



AIR DEFENSE/
THEATER MISSILE DEFENSE:

PREPARING FOR THE 21ST CENTURY!

"The moment of victory is the moment of greatest peril." Napoleon

Following each of its major 20th century conflicts, the United States dismantled the military forces which made victory possible. After the cold war's end in the late 1980s, however, our civilian and military leaders determined that we would remember and learn from history, not repeat it. To that end, the U.S. Army has emerged from the post cold war drawdown as a smaller, more effective, fighting force. Today, the Army has virtually completed its transition from a forward-deployed cold war army to a Continental United States (CONUS)-based power projection army. The Army is now embarked on a journey into the next millennium - a journey to Force Twenty-One, the Army of the Twenty-First Century. Air Defense Artillery (ADA) is in the vanguard of this journey into Force Twenty-One.

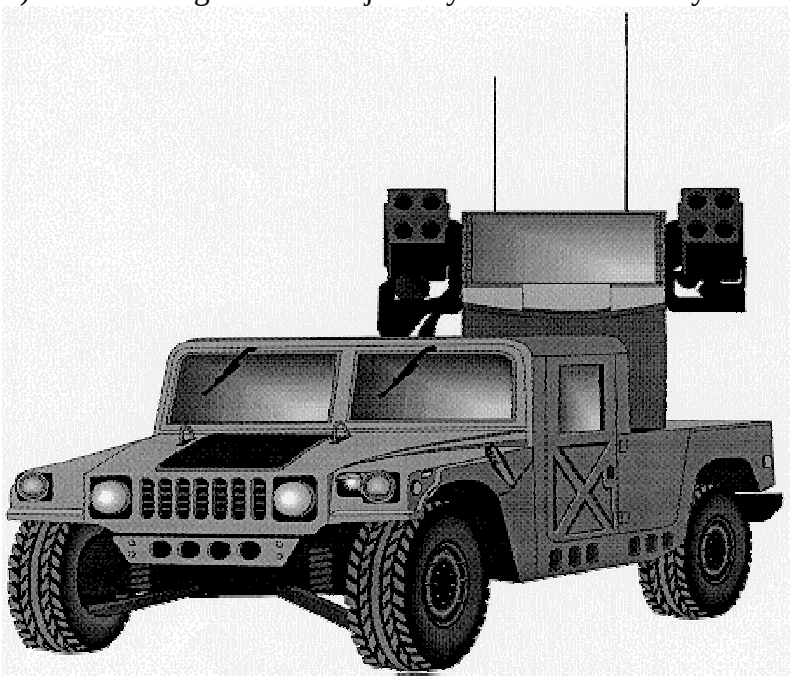


Figure 1 - The AVENGER

ADA is armed with a vision and equipped with a plan to make that vision a reality. The success of Force Twenty-One is highly dependent upon the ability to protect our forces and geo-political assets from aerial attack and surveillance throughout all phases of contingency operations. One of our greatest vulnerabilities is the threat from the third dimension - the air. The basic mission of Air Defense/Theater Missile Defense (AD/TMD) is providing protection in this critical area through all phases of an operation - from early entry through decisive operations. This mission requires a varied inventory of weapons and sensor equipment.

The AD/TMD roster currently includes the following weapons systems: AVENGER (Pedestal Mounted STINGER) (See Figure 1); PATRIOT missile of DESERT STORM fame, with PATRIOT Advanced Capability - 3 (PAC-3) upgrade (See Figure 2); Theater High Altitude Area Air Defense System (THAAD) - provides exoatmospheric engagement of Tactical Ballistic Missiles (TBMs); Bradley STINGER Fighting Vehicle (BSFV); CORPS Surface to Air Missile (SAM) - future protection for the maneuver force through decisive operations; Joint Tactical Ground Station (JTAGS - provides TMD support); and Ground Based Sensor (GBS) for the Forward Area Air Defense System (FAADS).

The overwhelming fixed/rotary wing threat of the Cold War era is being replaced by the TBM, Unmanned Aerial Vehicle (UAV), and cruise missile threats of today and tomorrow. Theater missiles provide hostile forces an inexpensive and affordable means to counter U.S. force projection, especially with weapons of mass destruction. These theater-wide threats operate in both attack and surveillance modes. Each Air Defense (AD) sensor must perform attack/surveillance functions against specified target sets - with most confidence probabilities at approximately 99%. To extend their battle space to its kinematics limits, the systems use organic sensor

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capabilities as well as external intelligence data.

For THAAD, this includes pre-launch detection of TBMs, as well as the more traditional post launch surveillance, thus, allowing the GBS to concentrate a portion of its radar resources in an extended range search. PATRIOT and CORPS SAM have the most varied target set. These targets range from low altitude cruise missiles and rotary wing aircraft through short-range ballistic missiles. Their operations will almost always be in joint airspace where a mix of friends and foes requires positive identification (ID) before engagements. The FAADS weapons and sensors must counter the very low altitude (pop-up) rotary wing aircraft, and both lethal and non-lethal UAVs, again in an area of mixed friendly and threat operations. Work is ongoing to improve FAADS capabilities against low altitude cruise missiles. All AD/TMD targets have distinctive electronic signatures which must be exploited to support the force protection mission.

ADA supports Electronic Warfare Support (ES) technology for enhancement and support of its surveillance and classification, discrimination, and identification mission, thus, rapidly providing electronic fit information and ambiguity analysis for specific airborne weapons platforms. A focus on UAVs and Cruise Missiles (CMs) with their associated parameters is now primary for the Army ADA reprogramming analysis team. The intelligence information provided will be contained in a Master Data Base (MDB) of platforms in order to do electronic fits and ambiguity analysis. The integration of these types of emitters into the MDB will significantly increase the ES contribution to Combat Identification.

The ADA reprogramming mission is evolving to meet the threat platforms of the future. Threat platforms of the past drove a requirement for a frame-work to provide rapid reprogramming information to ADA systems. This frame-work is object-oriented to provide flexibility for today's changing battlefield. The threat platforms of today, with emphasis on the UAVs and CMs, are now being added to the current Electronic Fit Information System (ELFIS) MDBs, so that intelligence information can be analyzed and processed by the ADA ARAT Cell.

The Fort Bliss ARAT-SC resolves friend/foe ambiguities using the ELFIS supported by validated Electronic Intelligence (ELINT) sources such as ELINT Parameters List (EPL), Electronic Warfare Integrated Reprogramming Data Base (EWIRDB), and others. The Fort Bliss ARAT-SC recently completed two AD/TMD related analyses including the FAADS Threat Emitter Profile and Operational Analysis Report (U), April 1994, and the HIMAD/TMD Threat Emitter Profile and Operational Analysis (U), March 1995. The cell has also provided surrogate target information on the AN/VSX2 sensor for both the AVENGER and PAC-3 in response to requests for threat library support.

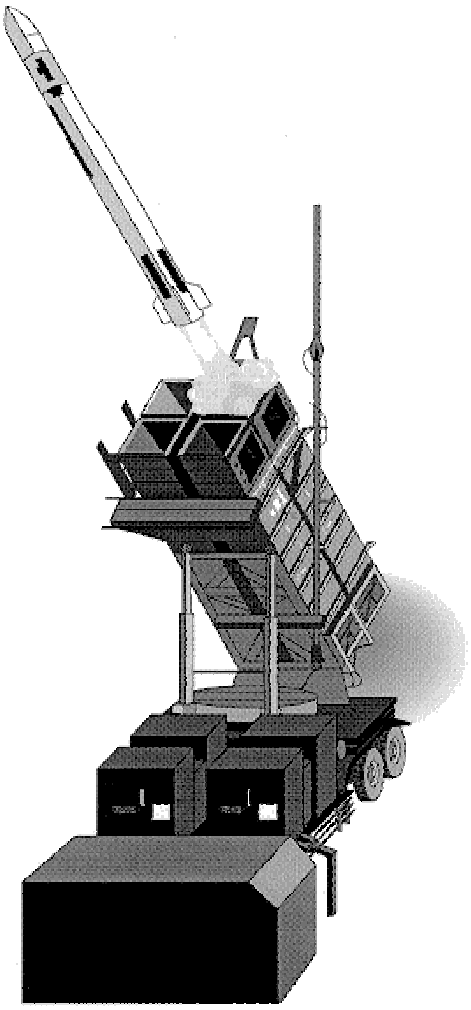

Figure 2 - The PATRIOT

The cell daily operations include database management, performing electronic fits and conducting ambiguity analysis to provide a continuing rapid reprogramming capability for the U.S. Army AD/TMD systems. Future articles will provide information related to reprogramming work by the Fort Bliss ARAT-SC on specific Air Defense/Theater Missile Defense systems. POCs are Mr. Al Thompson/ Mr. Ray Simmons, DSN: 989-5595.

RADAR WARNING RECEIVERS: THE AN/APR-39A (V) 1 (PART TWO)

Oscar Wilde once said, Mistakes. Life would be dull without them. With that thought in mind, we need to correct some mistakes that appeared in an article of the April 95 ARAT BULLETIN entitled "Radar Warning Receivers: The AN/APR-39A (V) 1." The direction-finding spiral antennas are the AS-3548 and AS-3549, not the AS-2891A and AS-2892A. The receivers are the R-2218, and not the R-1838. The frequency coverage of the AN/APR-39A (V) 1 is the C-D and H-M bands. With the new SANTA antennas which are being fielded as we speak, the new frequency coverage for the AN/APR-39A (V) 1 will be the C-D and E-M bands. Also, the diagram (figure 1) on page one of the article should have been titled the AN/APR-39A (V) 1 vice the APR-39A (V) 3. Now to move on and expand on a review of the system s operation.

The AN/APR-39A (V) 1 Radar Signal Detecting Set (RSDS) is controlled by three Intel 8085 microprocessors. Upon detecting a pulse train in the Radio Frequency (RF) environment, the RSDS determines its Pulse Repetition Interval (PRI), its PRI type (e.g. staggered, jittered, stable, etc.), scan characteristics (e.g., non-scanning, searching, conical, etc.), and Pulse Width (PW).

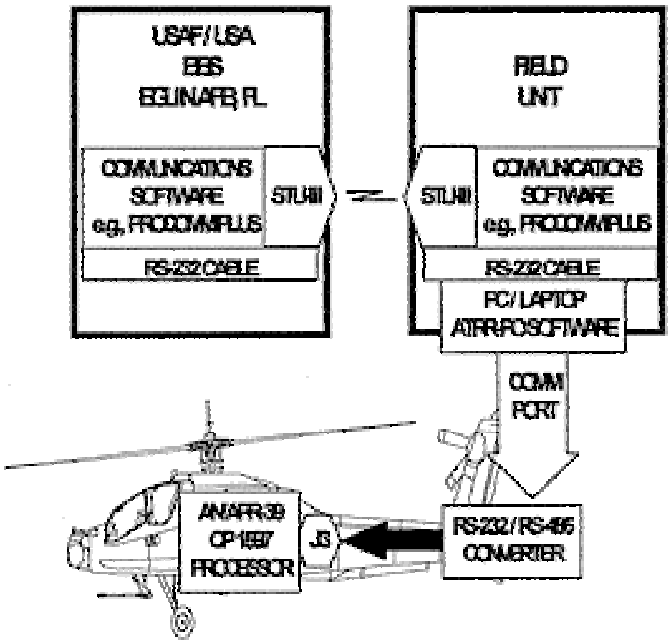

FIG1 MDS ELECTRONIC TRANSFER AND UPLOAD

This data is then directly compared to information stored in the system s Mission Data Set (MDS) in the User Data Module (UDM). If the incoming signal s parameters match, then the assigned symbol from the prioritized list in the MDS will be displayed on the IP1150A display. If a match is not made with the stored parameters, then a "U" (Unknown) will be displayed.

The threats in the MDS are selected, prioritized, analyzed, and coded by a joint team effort; by the personnel at ARAT-TA (Eglin AFB), CECOM-SED, and CECOM-NVES (Ft. Monmouth). The monitoring and programming of these threats are done on a continuing basis either as a block cycle upgrade or as a rapid reprogramming action. They are done in the event of changes to signal parameters in a specific geographical area, or if an enemy brings a threat into the area that was not already programmed into the MDS. This capability is a requirement based upon AR 525-15 direction. The prioritized displayed symbol(s) on the IP1150A, give(s) the pilot a Direction of Arrival (DOA), the condition of the emitter(s) lethality (whether the emitter is acquiring, tracking, or launching), and an audio alert.

In today's cluttered RF environment, it is more than possible that the received pulse trains may match several types of radars, e.g., an anti-aircraft (AA) emitter may match a surface to air missile (SAM) emitter. In cases like this where there is no way to break-out each emitter, the system will default to the highest priority emitter programmed in the MDS and display the associated alpha-numeric symbology on the IP1150A. The RSDS also has

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the capability of correlating lower band guidance emitters with higher frequency band tracking emitters.

The AN/APR-39A (V) 1 RSDS is always looking at the RF environment. It has a requirement to be able to detect and display the intercepted emitter extremely fast, so that the air crew may be able to analyze the threat, include it in their EW spatial awareness, and then decide what to do to counter it, e.g., jam it, kill it, avoid it. In a high density environment (either based on number of emitters or types of emitters) the RSDS will activate its adaptive threshold setting in order to allow the processor to work the highest priority emitters in the environment.

The RSDS has two important pieces of software programmed: the Operational Flight Program (OFP) and the MDS. When the system is turned on, both the OFP and MDS numbers appear at the twelve and six o clock positions on the IP1150A, respectively. The OFP is stored in Ultraviolet Programmable Read-Only Memory (UVPROM) chips in the RSDS processor. The MDS is stored in Electrically Erasable Programmable Read-Only Memory (EEPROM) chips in the UDM. The OFP can be changed to reflect improved capabilities for interfacing with other Electronic Combat (EC) equipment, identifying more complex emitters, and in presenting different format information to the air crew in specific aircraft, e.g., over a 1553 data bus.

Figure 2 - Many Army Aviation assets use the RWR, including the Apache helicopter.

Updating the OFP UVPROMs is more complex than updating the MDS in the UDM; old chips have to be removed and new ones added. Fortunately, OFP upgrades are not done very often. The U.S. Army is planning on an 18-24 month OFP update cycle, if it is warranted. The newest OFP that is to be fielded is 23.9 (it will replace all OFPs that have been fielded to date). It is to commence fielding in mid-95, and will be fielded with updated SANTA spiral antennas and newer MDSs which are available for download from the joint USAFAWC EC/US Army Reprogramming and Data Distribution System (alias the BBS) on-line at Eglin AFB, FL. PM-AEC and CECOM-NVES are scheduling the units for this major fielding.

Using new OFP 23.9, the MDS in the UDM can now be programmed without removing the UDM from the processor. This has been successfully tested in the CECOM-SED laboratory and demonstrated at TF 160TH on 10 May 1995 with the help of CW4 Brad Powell in their Systems Integration Office. Using a laptop, a cable with a commercial RS-232/RS-485 converter, and ATRR-PO developed software, a processor with a UDM containing MDS 018 was reprogrammed in about 60 seconds with MDS 030 (see Figure 1). MDS 030 was downloaded from the BBS, stored in the laptop, and then subsequently uploaded to the CP-1597. Surfing through the APR39AV1 Library on the joint USAF/ USA Bulletin Board System, U.S. Army units will now be able to select the optimum MDS for their missions.

We will keep you updated on this expanded reprogramming capability, as this will allow the U.S. Army now to play with the big boys i.e., the USAF and USN/ USMC. The U.S. Army now has the capability to rapidly reprogram its EC systems in an era when threats and geographical deployments for units can be undertaken overnight. POCs are Mr. Joe Ingrao/Mr. Harinder Purewel/ Mr. Pete McGrew, DSN: 992-8224.

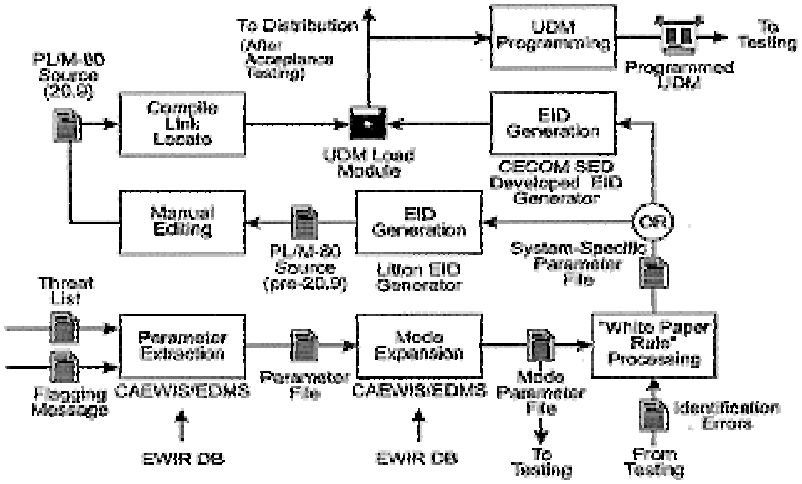
EWIR DATA BASE:
From An Airborne Electronic Combat User Perspective

(The following is extracted from a briefing presented by ATRR-PO during the EWIRDB Conference, held at Fort Monmouth, NJ from 22 - 26 May 95.)

Operational Overview

The Airborne Electronic Combat (AEC) Support Group, from CECOM RDEC SED Avionics/Intelligence and Electronic Warfare (A/ IEW) Branch, Fort Monmouth, NJ, provides software support for the entire life cycle of Army AEC systems. It performs Post Deployment Software Support (PDSS), develops Emitter Identification Data (EID), and provides software expertise during development of AEC systems.

PDSS is composed of developing, testing, and fielding Operational Flight Program (OFP) software fixes and enhancements in response to user needs. Much of the current work focuses on the development, optimization, and testing of EID. EID is composed of the a-priori information used to identify and respond to threat signals, while the OFP is the system base software which works by matching the EID information to the current system environment. The EID is produced by combining the Mission Data Set (MDS), which consists of a prioritized threat list, and threat parametric data into a format that the AEC system understands. The EWIR Data Base (EWIRDB) product serves as a basis for all parametric data contained in the EID.



The PDSS process is dependent on accurate data, thus, the reliance on the EWIRDB.

The fielded systems receiving PDSS from the AEC group are divided into three general classifications: Radar Warning Receivers (RWRs) such as the AN/APR (V) 2, AN/APR-39A (V) 1, and AN/APR-39A (V) 2; active deceptive Countermeasures sets (CMS) such as the AN /ALQ-136 (V) 1/5 and AN/ALQ-136 (V) 2; and passive Laser Detecting Sets (LDS) such as the AN/AVR-2 and AN/AVR-2A (see 4/95 BULLETIN). The AEC group also supports for systems under development, to include the Advanced Threat Radar Jammer (ATRJ) and the Advanced Threat Infrared Countermeasures (ATIRCM) system. The Program Manager - Aviation Electronic Combat (PM-AEC), serves as material developer and maintainer for these systems. PM-AEC relies upon the CECOM RDEC Night Vision/Electro- Optics (NV/EO) directorate to implement the development effort, while CECOM RDEC SED provides the matrixed software engineering support.

Historically, the U.S. Army has developed smaller, lower-cost AEC systems than its sister services. This results in lower-powered systems with relatively low processing power and memory resources. To maintain adequate system response time, considerable effort must be put into optimizing both the OFP and EID prior to flight time. This optimization includes determining, at development time, all ambiguities between threat systems in the MDS, and the fine-tuning of system adaptation data. At the same time, personnel down-sizing efforts in the Army have left us with a low engineer-to-system ratio. To overcome this, the AEC group looks to automation as a "force multiplier" to help make up for our declining personnel resources.

The AEC group has looked to the Air Force and Navy for several automated tools to use in developing EID and parametric data sets. Tools adopted by SED

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EWIR Data Base (continued)

include the Computer-Aided Electronic Warfare Information System (CAEWIS - U.S. Air Force), Electronic Warfare Data Management System (EDMS - U.S. Navy), and the Threat Information Data Extraction System (TIDES - U. S. Navy). Although not optimized for Army requirements, these tools provide an important automation capability for extraction and manipulation of the EWIRDB. In addition, the AEC group uses an AMES II Simulator (developed commercially), and a number of internally developed support tools such as the 39A(V) 1 EID Generation Tools and 39A(V) 2 Threat Tools.

The one commonality of these support tools is their dependence on the existence and format of the EWIRDB product. The EWIRDB is CECOM RDEC SEDs' only source of authenticated signature data for automation tools. CECOM uses the EWIRDB (and the EO/IR extensions) to support all fielded and developmental A/IEW systems for both mission data and requirements generation. As such, CECOM is very concerned that the EWIRDB product continue to be maintained and distributed in a form suitable for our existing automation tools.

Concerns, Complaints & Wishes

The concerns all involve automation issues and the interpretation of data. Currently, the AEC group feels that too much necessary information is held in the comments section (S05 file) of the database. Except for the K001 and C001 comments (the suffix tables), none of our automated tools can extract information from the comments file. The comments must thus be manually analyzed. Much information in the comments could be moved to the parameters (S03 file), by adding new parameter entries. This is particularly true of ad-hoc tables of complex PRIs, scan/RF/PRI correlations, scan patterns, etc., which could be easily represented as parameter entries, if one was defined. This relocation of information would allow more of the EWIR interpretation work to be performed by machines, allowing the analyst to concentrate on more critical problems.

The counterpoint to this desire is to have more, and more comprehensive parameter entries defined for modern, advanced threat systems (particularly in the area of electronic scanning and Track-While-Scan [TWS] systems). The need to describe things which defy textual description (such as complex scan patterns) lends weight to the argument for addition of some type of graphics capability (perhaps an S06 graphics file). A picture is worth a thousand words. For those data items which must be described in the comments file, we desire standards for the more common comments. This would help reduce misinterpretation of comments due to conventions used by different analysts and producer organizations. The end goal is creation of standards which guarantee deterministic interpretation. Thus, the EWIR user would interpret the comment as the analyst intended.

The complaints are all concerned with the comments file. These complaints include comments which are subject to interpretation, comments redundant (or contradictory) with information in the parametric trees (without providing additional information), and pre-expanded suffix tables (which are almost impossible to interpret manually).

There are several things which the AEC group wishes to see in the future (wishful thinking). One is the encoding of actual signals samples (for use by simulations people ala NSA's Threat Player). Another is providing a specification for deterministic mode expansion (giving users the capability to talk about "Mode X of Elnot Y". A third is providing wide-spread on-line access to the most current data. Finally, they would like to see a provision to provide graphics for the data when applicable or possible.

The above discussion is meant to stimulate thinking about the EWIRDB from the perspective of one user group. It does not represent any official position by the Army. The ideas are presented to the community for the purpose of generating discussion to stimulate improvement of the EWIRDB product. POCs are Mr. Sok Kim/Mr. Henry Thorpe, DSN: 992-1337.

"ARAT Bulletin"

will be published quarterly and is intended to provide the ARAT community with current information. You are invited to submit input for improving this publication, or present articles which will be of interest to our readers. You may fax correspondence to the Editor at (908) 532-5238. Include your name, telephone number, and source of information.

EWIRDB CONFERENCE HAPPENINGS

The 1995 Electronic Warfare Integrated Reprogramming Data Base (EWIRDB) Conference was held on 22-26 May at Fort Monmouth, NJ. The conference, hosted by the CECOM RDEC SED ATRR-Project Office, had over 100 attendees from the four military services as well as several allied nations. EWIRDB producers and users were brought together in a formal and informal setting to discuss common problems, establish future trends, and develop plans for product improvement. Briefings and committee meetings were held throughout the course of the week. The following provides a look at some, but not all, areas of discussion which occurred.

EWIRDB attendees included U.S. Air Force representatives from several agencies.

A number of common themes repeatedly surfaced throughout the conference. Much of the EWIRDB community is experiencing reorganization, resulting in many new people coming on board. Many organizations are downsizing and representatives from several agencies face a personnel shortage to perform EWIRDB work. Thus, there is a great deal of interest in productivity enhancements and in efficient tasking to ensure more effective EWIRDB production and use.

Resources are being reduced due to staffing and funding pressures at a time when the requirements are growing. The new emphasis on gray and blue systems has significantly increased the requirements for EWIRDB production and complicated the design of mission libraries. Increased automation by EWIRDB users demands a higher precision and accuracy in the product.

Staffing and training issues become critical with downsizing and reorganization. Use of the EWIRDB is very labor intensive and relies on subject matter experts who require a long learning curve. Selective prioritization, automation, and streamlining are being used to minimize the impact on the EWIRDB. A Memorandum of Agreement (MOA) between the Air Force Information Warfare Center (AFIWC) and the

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TSS RAPID REPROGRAMMING REQUIREMENTS REVIEW AND SURVEY

The Army (Target Sensing Systems) Rapid Reprogramming Project Office (ATRR-PO) is conducting a Review and Survey of all Army Target Sensing Systems (ATSS) Rapid Reprogramming requirements. A review team has been established, based out of the ATRR-PO, to conduct the review and survey.

The Review Team is completing a review of Army technical research and development documents. This will be followed by a review of all Army requirements documents for Target Sensing Systems, to include Mission Needs Statements (MNS) and Operational Requirements Documents (ORD), approved by Headquarters Department of the Army, in the Office of the Deputy Chief of Staff for Force Development.

With support from Headquarters, U.S. Army Training & Doctrine Command (TRADOC), in the form of a Systems Requirements Review, the Review Team will also survey all requirements documents under development within the TRADOC Centers and Schools.

Finally, the Review Team will visit with selected Project and Product Managers of ATSS to learn how the rapid reprogramming requirement is being engineered into systems still in research and development. Project completion is scheduled for the first quarter of FY96. POCs are Mr. Sok Kim/Mr. Ralph Spinelli/Mr. Mark Russo, DSN: 992-1337.

EWIRDB Conference (continued)

Science & Technical Intelligence (S & TI) Centers will improve reporting on gray emitters and eliminate duplication of effort.

Communications within the EWIRDB community are a major issue. EWIRDB production involves fourteen offices at ten different organizations. There are hundreds of user organizations with dozens of different applications. Policy issues, technical issues, and changes affect all of them. User problems are rarely reported, and even then, reports do not always reach the proper person. Response to user reports has been poor. Coordination and continuity within the community is continually becoming more difficult.

Some communications strategies are being defined with points of contact being documented and published. Increased electronic and network communications methods are now available and are being exploited. Small representative working groups are being established for efficient coordination of policy and technical issues. Procedures for tracking action items are being defined within and between EWIRDB organizations. The EWIRDB newsletter will be revived and published quarterly, to correspond with each EWIRDB update released on CD-ROM.

Automation is a major initiative throughout the EWIRDB community. Software tools, networks, and new database concepts are being deployed to improve quality and efficiency. Producer automation can stimulate improvements in efficiency and quality. User automation tends to impose new and costly demands on the EWIRDB producers. Software is usually not very smart or forgiving. The EWIRDB is a very sophisticated and complex product, while the automated user tools are still rudimentary and simple. Automation promises better and more efficient Electronic Warfare (EW) data analysis but imposes new demands on design and production.

Quality has become a major issue in the EWIRDB. Standards of precision and complexity have both risen dramatically. Resolution of even minor problems can require significant effort by many users. Several recent initiatives will address the quality problems. Production tools from National Air Intelligence Center (NAIC), Missile and Space Intelligence Center (MSIC), and others will improve both the quality and efficiency of new and updated files.

The above provides a sampling of issues discussed during the conference. Many more topics and issues were addressed during the course of the week. Anyone desiring additional information can contact the ATRR-PO at Fort Monmouth. POCs are Mr. Sok Kim/Mr. Ron Murdock, DSN: 992-1337.

ARAT BBS USER MANUAL UPDATE

The ARAT-PO has completed a draft of the ARAT Bulletin Board System (BBS) User Manual. This document provides users with information concerning set-up, concepts of operation, and operations. The ARAT-PO is releasing draft copies of the User Manual for review by the reprogramming community. Reprogrammers are encouraged to submit comments, corrections, and suggestions for improvement, to the ARAT-PO. Your assistance will ensure that the User Manual is properly focused on user needs. Anyone interested in obtaining copies of the User Manual should contact the ARAT-PO at DSN: 992-3512 or (732)532-3512.

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